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In between the global and the local: The politics of mathematics education reform in a globalized society

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Abstract: The current processes of globalization and internationalization have represented both opportunities and hindrances for the different actors involved in mathematics education practices. Those processes – happening mainly outside the classroom– link practices at different levels in ways which are not visible for neither practitioners nor researchers. Understanding the complexity of reform demands an opening of our research focus in order to allow the construction of connections between micro and macro spheres of social practice. Based on my study of reform processes in mathematics in Colombia, I illustrate how internationalized ideas penetrate into the mathematics educational discourses in this country and contribute shaping policy in similar directions. At the same time, I show how the diversity of national and institutional contexts, in interaction with local practices of teachers in schools, shape the directions that reform intentions take in practice.

A first glance at Esperanza Secondary School[1]

I got ready for my first visit to the school. Comfortable jeans and a warm pullover should protect me from the Bogotan cold in the early morning. As I drove from my home towards the west of the city, the landscape changed and green residential areas were replaced by many small businesses: bakery shops, beauty parlors, groceries stores, and plenty of garages. Public transportation became denser and buses stopped here and there to collect the crowds of people in their way to work. Uniformed school children also tried to catch public transportation despite the burden of big school bags on their shoulders. The school activities started at 6:45. I reached the school gate in good time. The whole place was empty, and I could only see two street children approaching slowly due to their desperate search for food in the piles of garbage. The school redbrick building was notorious for its high surrounding walls and for its height that exceeded most of the two to three stories houses in the neighborhood. The many broken windows and the thin grid-bars behind them were also a typical symbol of a District school building. The gate was closed and I waited outside while observing the large, empty space in front of the school. This sand-dusty area was decorated with scattered rubbish, the natural result of having many school kids around. Ten minutes after, children and teachers started arriving; some jumped

[1] The Spanish word *esperanza* means hope. This fictitious name illustrates what I perceived in this school: teachers who, despite the adversities, have a strong commitment to their work, and hope that what they do can contribute to the betterment of their students' life conditions.

down a public bus, others arrived walking, and some of the teachers came by car and parked inside the walls of the school. I decided to go in as well.

After mentioning Mrs. Viviana, my contact, the gatekeeper let me in and told me to wait in the roughly paved school-yard. Viviana arrived and she welcomed me warmly. She introduced me to all teachers who crossed our way to the second floor, where the academic coordinator's office was. Irma expressed their willingness to share their everyday with me, and their expectation of feedback. Viviana gathered the group of mathematics teachers and suddenly five women in their thirties and forties were standing by the door, ready to meet me and go to their classrooms for the start of the school day. Laura, Julia, Mercedes, Ana and Viviana introduced themselves cheerfully. We shook hands and I mentioned shortly my intention of being a colleague to discuss with and of providing help in whichever form they considered relevant. They ran to class when they heard Juan, the discipline coordinator, approaching to hurry them up into their respective rooms. I was also introduced to Juan whose cordiality and roughness helped keeping the school under control.

Irma introduced me shortly to the basics: the school building, the administration offices, the staff room, the cafeteria, the library, the computer rooms and the science labs. She showed me the schedule and indicated the distribution of hours of the math teachers. When the school bell rang, well-dressed teachers with aprons switched classrooms. There were more women than men among the 40 teachers in the school. The 910 students were adolescents between 11 and 19, and were distributed in six grades of three or four groups per grade. Each class had in average 41 students. Students wore uniforms and students' appearance ranged from a very tide, clean and neat look to quite old and sometimes dirty apparels. Students seemed not to pay particular attention to me despite their recognition that I was not one of them. Still, they were not hostile. On the contrary, I approached many and made good pals with some. The building, classrooms, desks, offices, walls, toilets, and, in general, all facilities were worn out by the continuous use and abuse that students in three different school shifts make of them during the whole day, ten months a year.

Many things struck me that day: a desk graveyard at the end of a corridor, the ill smelling toilets, the bars behind the many broken windows, and the highly risky building with its slight inclination and a severe crack. But above all I got struck by the enthusiasm and dedication of all the staff. In these tough conditions, teachers seemed to do their best for the education of these adolescents. The school day was over. The dusty, empty area in front of the school was now life plentiful: Ice-cream vendors, pirate CD and cassette retailers, fast-food sellers, hand towels and clothes bargainers spread their little informal shops all over the place. Students stormed out of the school. Teachers left in a hurry to make in on time to their next job, and I left back to my protected, privileged home, on the other extreme of the city.

Mathematics education reform in a global context

Esperanza Secondary School, as many schools in the world at the end of the 1990's, was undergoing change, also in the teaching and learning of mathematics. The story above grasps my impressions when visiting this typical, low-class state school in

Bogotá, Colombia. The story captures observations which in principle seem not to be directly related with the actual teaching and learning of mathematics in classrooms. However, they highlight the environment in which the practices of leaders, teachers and students take place. As I have argued elsewhere (Valero, 2002), such environment is of the most relevance for understanding the social, political and organizational dynamics within which the transformation of mathematics education practices happens. During my stay in Esperanza while carrying out my research, I realized that it is not possible to disassociate mathematics classrooms from their context. However, that context was not only to be conceived as the immediate frame that the school organization provides for mathematics teaching and learning in classrooms, but also as the structural frame that the social, political and economic situation of a country in a globalized world offers to those localized educational practices.

The surroundings of the school with street children and the daily blooming of an informal economy at the front gate of Esperanza permeate the school. The following episode made very clear to me its significance for mathematics education: A pair of students in a 10^{th} grade class seemed not to be interested in math and adopted a quite irritating attitude towards their surroundings. Despite of my attempts to convince them about the advantages of being good in school and at math, on of them expressed his concern:

> José: The only class I would like to pay attention to is English because I want to get out of this fucking place and go to the USA. Though, I don't even manage to say 'Hello, good morning'. (Valero, 2002, p. 490)

How can one interpret José's concern without linking students' intentions to learn (mathematics) with the fact that, given a deep economic crisis, migrating was the only possibility for many Colombian to have a life? How can one consider policy-makers', school leaders' and teachers' intentions and efforts of transforming educational practices without considering the connection between the latter and the intricacies of the social context in which they are constituted? How can it be possible to shed light into the processes of change in mathematics education in a school such as Esperanza, in a country such as Colombia, without seeing that process in relation to the challenges that globalization poses to it?

In this chapter I contend that mathematics education research, in particular research on reform processes in the teaching and learning of mathematics, need to open its scope in order to gain a broader understanding of the multiple levels of social action implicated in mathematics education reform. I will also argue that such an opening in scope is a demand posed by globalization processes which, on the one hand, make more evident the constitutive relationship between social practices in micro-contexts and social practices in macro-contexts, and, on the other hand, have worsened the distribution of material, human and knowledge resources in the world. If mathematics education research and practices are to be committed to social equity and justice, then they need to address the ways in which they are implicated in the production of a particular social order. Based on the case of the Colombian educational reform in mathematics education at the end of the 1990's, I will present an analysis that highlights the connection between global trends and particular events in Esperanza Secondary School. The examination of the case does not only intend to

provide insight into a particular context, the Colombian context (about which international mathematics education research has little information), but also and primarily intends to illustrate that change in mathematics education is at the crossroad of global and local contradictory forces. Finally, I will present some concluding reflections about the challenges that globalization poses to mathematics education research with a concern for social equity at local and global levels.

The macro-context of mathematics education reform in Colombia

Colombia is a diverse country. Such diversity, expressed in the heterogeneity of Colombian peoples, is associated with geographical variety resulting in a number of regional aboriginal subcultures and with different patterns of Spanish colonization. The social and economic development during Colombia's independent time, from the 1820's until our days, has added divisions related to race and socio-economic status. Affiliation to any of the two traditional political parties has been another factor of strong differentiation. Participation in illegitimate political activities –such as militancy in any of the many leftist guerrilla groups that has had an historical significance since the 1950's–, paramilitary groups –such as militancy in many of the private armies that defend private interests in zones of conflict–, or simply criminal activities –such as the participation in organized networks of drug production and traffic– have also been an additional factor of fragmentation in Colombia. Such diversity of peoples and life experiences make part of both the context of Esperanza Secondary School and of its very same constitution. The teaching happening there, the experiences of leaders, teachers and students –as much of my own experience as a researcher in the school– cannot be discussed without considering the structural factors that interpenetrate the world of the school. Therefore, a starting point to examine the interplay between the context of the school and the teaching and learning of mathematics in it is considering the historical framing of events happening there at the end of the 1990's.

Three events had a strong influence in the educational development during the 1990's in Colombia, and provided a general context for the emergence of the new Currricular Guidelines in School Mathematics (MEN, 1998). These events are: the introduction of neoliberalism as a "necessary" model for economic and political governance for the new times of globalization and internationalization; the proclamation of a new Political Constitution that in 1991 emerged as the first inclusive and participatory political agreement in the democratic history of the country; and the promulgation of a new Law of Education that intended to coordinate the national educational system to both internal and external challenges.

The decade of the 1980's represented a time of change in most Latin American countries. In political terms, it was a time of democratic transition after long dictatorships. Although this was not the case of Colombia, having the most stable representative democracy in Latin America, the country entered a process of democratic progression intended to renew the old frames of political participation. Political changes in Latin America are not independent from economic changes in the whole region of the Americas and in the world. The structuralist, protectionist economic management that characterized the region entered a crisis when new

international demands for internationalization and globalization started pushing the adoption of neoliberal ideas, with almost opposite views of economic and political management. In economic terms, neoliberalism stands on the assumption that the internal logic of the market is powerful enough not only to regulate all exchange relationships, but also to shape social and political relationships in the "desirable" direction of individual freedom of choice. Rational individuals who can choose, and worldwide free markets are two tenets of this new version of classical liberalism. Opposed to a centralist, paternalist and protectionist organization, neoliberalism proposes a strong decentralization of administration, a reduction of the State including its welfare functions, and a transference of the provision of different services into the realm of the private. Besides, the advance of the "informational society" (Castells, 1999) as a kind of post-industrial organization where the sources for value –and therefore of power– are not only labor and capital but also knowledge and information has also altered the time and space boundaries to the foundation of those sources. The limits of national States dissolved and broader boundaries are now in place, in an exchange of traditional and virtual goods. Science, technology and constant learning capacities are part of the conditions that a country must have as sources for a powerful positioning in the global, virtual village.

The neoliberal presidency of César Gaviria (1990-1994) echoed the international scene and soon started to introduce changes in the country, among them a reform in the administration of education. This small reform was based on the argument that the adoption of a decentralized administration of education was an effective way of tackling the education crisis. Such a crisis was made evident in the inefficient, bureaucratized, authoritarian central administration, in the low levels of student achievement, in the high levels of drop-outs, and in the lack of acknowledgement of local differences in the student population, among others (Londoño, 1998). This diagnosis was compatible not only with similar reports from other Latin American countries, but also with the recommendations that emerged in international scenarios such as the "World Conference on Education for All" held in Thailand in 1990 and organized by the UNESCO (1992). In educational terms, neoliberalization meant in Colombia the adoption of a universal, global agenda where "achieving education with equity and quality, decentralizing curricular policies, educating democratic subjects, adopting the scientific-technological revolution, and determining a core curriculum" (Londoño, p. 54) are priority issues. These tenets certainly do not disagree with the development of educational systems in richer nations, as Apple (1996, 2000) has discussed extensively.

The Political Constitution of 1991 also contributed significantly on shaping the political and educational landscape in Colombia during the 1990's. Although Colombia did not have long and strong dictatorships –in contrast to most Latin American countries– the political history of Colombia developed as a continuous exclusive struggle for the control of the State and its resources. The political history of Colombia until the 1960's was characterized by violent confrontation between two traditional parties for the imposition of single-party, hegemonic regimes. In the 1950's and 1960's a new kind of exclusive conflict started when different left-oriented guerrillas were formed as an attempt to gain access by the illegitimate use of armed force. The 1990's was a critical moment in which the traditionally excluded sectors –poor, indigenous, peasants, guerrillas– together with recently excluded powers –drug-traffickers with tremendous economic power and paramilitary groups–

and the traditional dominant elite came together for a reconciliation agreement that ended up with the Political Constitution of 1991. This Constitution was the symbol of national reconstruction since it was the first, really inclusive attempt for bringing together the historically fragmented Colombian society. After a strong period of narco-terrorist violence and the re-insertion of some guerrilla groups to civility, a popularly elected Constitutional Assembly proclaimed the New Political Constitution of 1991. This document marked the end of a constitutionally closed democracy and the start of a participatory democracy (Murillo & Valero, 1995), which established legitimate means and procedures for community political participation. Participatory democracy, in a country with such a history of political, economic and cultural exclusion, was seen in Colombia as a way of reconstructing a nation on the base of equal possibilities for active political participation.

The Constitution declared education as a key element of such a reconstruction process and, therefore, as part of the social rights to which all children should have access. This fact is an improvement in relation to the previous political frame since now the Colombian State must, not only regulate and inspect the provision of education, but also protect and make effective the right of education in its fundamental function of building a democratic society (Londoño, 1998, p. 62). Eight constitutional amendments define five central ideas concerning education: the State is the warrant of the educational service and its regulation in broad terms; education is a fundamental right of Colombians; freedom, democracy and peace are central values and aims of all education at all levels; education should contribute to the consolidation of a national culture; and finally, education should provide a wholistic formation that enable human beings to participate in national and international development.

Within this broader frame, the General Law of Education (MEN, 1995) and its corresponding administrative act established a new educational organization in order to cope with the constitutional demands. The General Law declares the general aims of education, the rights and duties of the whole educational community –students, teachers, leaders, parents and local authorities–, the structure of the system in levels and types of education, and the administration of the whole service both nationally and locally. The aims of the whole system are: the full development of the individual and his/her personality in all aspects –physical, psychological, intellectual, spiritual, moral, social, ethic and civic; the development of democratic values and behaviors such as peace, tolerance and participation in decision-making; the development of individual and collective access to knowledge, research capacities and critical attitudes in all areas of the natural and social sciences, and the humanities and aesthetic disciplines; the development of an awareness for personal and social health, as well as of the maintenance of the whole ecosystem; the development of capacities for fulfilling the demands of the work market in relation to production and to technological advancement; and the development of a national awareness, recognition and respect that at the same time is the base for the recognition a regional and worldwide awareness.

These groupings evidence the vision of education and national development that underlay the whole educational reform, according to the Constitutional intentions. In order to build a Colombian society for future challenges, the individual, in all her potential, has to be put in the center of a society that needs to learn how to be socially democratic. Knowing is at the service of not only more knowledge

production, but also the maintenance of the environment, the boosting of production and technology, and the consolidation of a nation that can also participate as a part of a global world. In order to achieve this vision in the formal education system, the General Law set up the general aims for the whole formal education system and for each level of schooling, including the compulsory school subjects. The Law also established different mechanisms of reform implementation and institutional development, instituted new regulations for teacher education, set up the frames for a whole new assessment system based on outcomes, and regulated the local, regional and national administration of the educational service. Shortly, the General Law of Education set a framework that intended to bring the transformation of the Colombian educational service in many aspects such as policy, administration, funding, curriculum, teachers' professional development, assessment, school organization, etc. The broad educational change was conceived as a general national transformation for the challenges of both the national demands and the internationalized world.

Problematizing the macro-context

The previous account provides points to the complexity of the broad macro-context in which mathematics education reform was introduced. However, is the macro-context of mathematics education in a country such as Colombia unproblematic? If not, are there challenges that this particular macro-context poses to mathematics education in Colombia and in Colombian schools such as Esperanza Secondary School?

First of all, a strong critique has been raised about the connections between democracy and education in the frame of the advance of neoliberalization in an international, globalized, informational order. Free, rational individuals can choose among many options available in the market. "Choice" is essential to the basic economic laws of demand and offer, and to market economy. In this sense, deregulating and freeing individual choice is the key to economic activation. In agreement with this idea, it becomes imperative to restrict the role of the State in controlling economic transactions, and in providing the redistribution of welfare. Free, rational individuals can, by their own initiative, associate in order to solve their problems and to fulfill the spaces that the State used to occupy with its provision of basic welfare. Privatization and individualization are central to the free choice – participation– that rational individuals also exercise as part of their action. This is the theoretical coherence of such ideology. Nevertheless, it is not a secret that this theory has not worked so well in practice. After at least a decade of the (forced) expansion of these ideas around the world the divide between supporters and opponents is increasingly evident. The adoption of neoliberal economic ideas in many developed nations, and their enforcement into almost all developing nations is showing that there are many double sides to the idea of the freer the market and the freer the individuals, the stronger the economy and the democratic political relationships (McLaren, 1999). The gap between rich and poor, nationally and internationally, has increased recently due to the structural adjustment of political and economic structures to the new international parameters. So have increased problems of equity, which put at stake the democratic discourse associated to all these changes.

In education there are significant examples of these contradictions. In the cases of the USA, England and Australia, where large sectors of public schooling have been privatized and marketized. Apple discusses how the assumption of the improvement of quality in the educational service given the introduction of competition into it does not hold in reality, and shows that the atomization of decision-making in highly stratified societies creates the fallacy of equal opportunities and participation. Apple concludes that "neoliberal policies involving market 'solutions' may actually serve to reproduce –not subvert– traditional hierarchies of class and race" (Apple, 2000, p. 247).

Globalization, the process due to which our environment –in political, sociological, economic, or ecological terms– is permanently reconstructed through inputs from all corners of the world, goes hand in hand with the expansion of particular economic and political models. In this sense, globalization also relates to the apparently shared belief that a given kind of environment is desirable, and that there is some kind of universal commitment to the achievement of certain ideals. The expansion and acceptance of a trust in Western, capitalist values –phenomenon named by Fukuyama (1992) "the end of history"– legitimize a false universalism (Eagleton, 1996) which "has not, however, freed humankind from history but rather extended the dispensation of prehistory's tempestuous reign of cruelty" (McLaren, 1999, p. 6).

In education globalization has been associated with discourses that emphasize the need to form flexible, ready-for-change individuals, whose main competency is their ability to "learn to learn". A questioning to this idea tackles the view of humanity underlying this discourse. Masschelein (2001) argues that the discourse of the learning society is highly risky since it presents the whole educational enterprise as a mechanism of *zoological* survival. This view opposes a conception of life as *human* existence, where unique subjects search for meaning, in an attempt to initiate events that contribute to secure a sustainable, durable common world. As a richer conception of education is suppressed, education becomes a mechanism that strengthens individualization and the selection of the most adaptable beings. Education –under a façade of accessibility– is in fact promoting stratification. As Flecha (1999, p. 67) points, "the knowledge prioritized by the new forms of life is distributed unevenly among individuals, according to social group, gender, ethnic group, and age. At the same time, the knowledge possessed by marginalized groups is dismissed, even if it is richer and more complex than prioritized knowledge. More is therefore given to those who have more and less to those who have less, forming a closed circle of cultural inequality".

The implications of the global context have also been discussed for the Colombian case. Londoño (1998), in her analysis of the General Law of Education as a national project of school autonomy and democracy, discusses how the grounding of the Law in neoliberal ideology poses two main difficulties. On the one hand, neoliberalism has set homogenizing forms of thinking and feeling, by means of an "unlimited expansion of the rational domain" (p. 58) and the institutionalization of techno-scientific processes for the production of the social world. Educational autonomy and the discourse of educational democratization in this context can only have an instrumental connotation. They refer to the "efficient and effective execution of assigned tasks according to parameters previously established by extra-social organisms" (p. 59), but not an authentic possibility for participants in educational

processes to set their agenda. In this sense the contradictions of a restricted autonomy are installed in the educational arena. In such a landscape it is very easy for the most apt –the quickest to grasp the official discourse and the strongest to bring it into practice– to survive and be able to put forward their agenda. A growing differentiated gap between people and their actual capacity to act constitutes a democratic challenge.

On the other hand, the extreme emphasis on the individual and the conception of liberal democracy through representation in decision-making goes against views of radical, collective, deliberative democracy in which groups of people really act for the transformation of their life conditions (Valero, 1999). These two obstacles point towards the inconsistency of achieving a democratic social reconstruction, such as the one intended by the Political Constitution of 1991, through education, as proposed by the General Law of 1994, in a dominantly neoliberal economic and political scenario. As Londoño (1998, p. 60) concludes it is questionable the extent to which it is possible to build a new social imagination, that can represent a change from old, traditional democratic and educational projects.

The previous discussion makes clear that there are problems and contradictions in the macro-context and this may pose serious challenges to mathematics education in countries such as Colombia and in schools such as Esperanza. I find resonance between these problems and what Skovsmose and I (Skovsmose & Valero, 2002) have identified to be two central paradoxes of the current global, informational order. The *paradox of inclusion* designates the contradiction between the discourse of the current neoliberal, globalized model of social organization, which emphasizes democracy, universal access and inclusion as a stated principle, and the deep disempowerment and exclusion that certain social sectors actually experience as a result of the practices associated to that discourse. The *paradox of citizenship* refers to the contradiction between the role of education intending to prepare for active, autonomous, critical citizenship, but at the same time ensuring adaptation of the individual to the given social order. This paradox emerges from the fact that the learning society, claiming the need of relevant, meaningful education for current social challenges, reduces learning to a matter of necessity for adapting the individual to social demands.

The presence of these two paradoxes in our current social, global organization is problematic since it challenges very basic principles of a social, radical democracy with a concern for equity and social justice. If education, in general, and mathematics education, in particular, are seen as key practices in the current order, both are in the critical position of risking contributing to the installation of the two paradoxes. Therefore, people involved in these practices have the responsibility of facing them. However it is not clear and straight forward how this can be done through mathematics education reform –more precisely, through the process of transformation of the practices of educational authorities, policy makers, school leaders and teachers in schools such as Esperanza Secondary School.

In what follows I will approach the mathematics education in Esperanza Secondary School through presenting the policy frame in which mathematics education in the country was supposed to be carried out and the way it meets the mathematics education practices in the school. My hope with such a presentation is to provide elements to analyze whether, at least in a policy level, there is a possibility for mathematics education to engage in responding to those paradoxes.

The mezzo-context of change in Esperanza Secondary School

Coming closer to the mezzo-context of mathematics education change in Esperanza Secondary School in the time of reform at the end of the 1990's implies taking a look at, at least, two aspects. In first place, we need to explore the Curricular Guidelines for Mathematics as the policy frame of change in mathematics education in Colombia. Second, we need to go back to the question about whether mathematics education in Colombia, as proposed in those guidelines, has a chance of facing the paradoxes that the macro-context poses to it.

Examining the Curricular Guidelines for school mathematics

The General Law of Education established a broad aim for mathematics education in both basic secondary and middle school. These levels of schooling should aim at "the development of reasoning capacities through the mastering of numerical, geometrical, metric, logic, analytic, sets, and operations and relations systems; and through their use in the interpretation and solution of scientific, technological and everyday problems" (MEN, 1994, Amend. 22). This aim was the basis for the formulation of curricular guidelines in mathematics. Led by the mathematics education research team in the Ministry of Education, a national group of researchers, teacher educators and teachers started a process of discussion in order to produce a curricular guidelines document (MEN, 1998). This document was meant to inspire teachers for discussing fundamental issues about the teaching and learning of mathematics. In this way, it could help teachers making informed decisions in their task of designing and implementing curricular programs. This document is divided into three main sections: an introduction, a section on points of reference for curriculum development, and a section with conceptual ideas for teacher education.

The first introductory section addresses the general context for the ideas about the teaching and learning of mathematics put forward by the document. The guidelines intend both to overcome the limitations of the previous centralized, national curriculum developed by the Ministry mathematics education research team during the 1980's and early 1990's, and to build on its achievements. The old curriculum, based on "Systems Theory" in mathematics[2], presented a view of mathematics which integrated the positive aspects of the structural conceptualization of the "New Mathematics" reform trend and some Piagetian constructivist ideas about learning processes, together with their didactical implications (MEN, 1991). The old curriculum presented in a detailed manner the theoretical approach for structuring the contents, the general aims and particular objectives to be attained in the teaching and learning of mathematics in all grades, and the content organization and the teaching methodology suggested for the teachers. The process of

[2] A system (S) is a set of objects and their relations and operations. Every mathematical system may be defined in terms of a sub-set of objects (A), a sub-set of operations (O), and a sub-set of binary relations between the objects of A, (R). In general terms, a system may be defined as S=(A, O, R). The curriculum for school mathematics proposed to work with 8 kind of systems: number systems, geometric systems, metric systems, data systems, set systems, operations and relations systems, and analytical systems. An example of a number system according to this view is that of the integer numbers. This system may be defined as (Z, {<, <=, >, >=}, {+, x}) (MEN 1991, pp. 9 -17).

implementation not only emphasized the explanation of the proposal to the teachers, but also highlighted the necessity of permanent inservice teacher training and of the production and distribution of instructional materials, mainly textbooks. This curricular proposal did not have the expected results in improving student's conceptual knowledge and capacities due to many reasons. One of them had to do with the rejection that the proposal found among many teachers who criticized its structuralist and didactic-technological nature (García, 1996). Another reason had to do with the internal contradiction of the proposal concerning the contents, methodology and aims for the teaching and learning of mathematics. As Agudelo (1996) notices, the emphasis on Piagetian theory as a support for an active teaching methodology contradicts the character and nature of the selected content, which does not appeal for active participation of students in building their own knowledge. Another reason of failure had to do with the detail of the national curriculum in terms of the contents that needed to be covered. Strict, detailed syllabi together with national high stakes tests in mathematics ended up in a content focused, procedural teaching and rote learning (Valero, 1997). Finally, although there was a large investment in inservice education and teaching materials production, these activities did not promoted a questioning of traditional teaching practices in favor of the adoption of the new proposals. Instead, they allowed traditional views to get re-accommodated within an apparently different didactical discourse (Perry, Valero, Castro Gómez & Agudelo, 1998).

Despite of these negative sides, the Curricular Renovation of the 1980's represented some advances for mathematics education in the country. As García (1996) also mentions, this was the first, systematic attempt to spread strong ideas about the didactics of mathematics among mathematics teachers. General Piagetian principles acquired meaning when connected to particular mathematics learning and teaching processes. From this Ministry led attempt emerged an institutionalized discussion in the country about mathematics education, especially around the idea of "systems".

The new curricular guidelines put forward in 1998 tried to take advantage of these positive aspects. It kept the idea of school mathematics as knowledge systems, but introduced together with them the advances of international mathematics education research concerning constructivist, problem-solving oriented teaching and learning processes as fundamental ideas about how teachers and students could interact in a classroom. In contrast with the previous guidelines –and in agreement with the discourse of autonomy and decentralization in the Political Constitution and the Law of Education– these guidelines do not intend to be a centralized, detailed organizer of teachers' work, but an open guide for reflection among teachers in their role as curriculum designers and implementers. Mathematics teachers have the responsibility of choosing contents and methodologies that are appropriate to their particular students, and which are in agreement with their school's educational project. Nevertheless, the guidelines set the ultimate goals of all mathematics education, which are "to improve students' conceptualization capacities, to promote their understanding of their possibilities, and to develop competencies for tackling the complexity of life and work, dealing with the resolution of conflicts, managing uncertainty, and strengthening the culture for a healthy, wholistic life" (MEN, 1998, p. 17, my translation).

The second section of the Curricular Guidelines document puts forward five topics that teachers need to address when designing their own curriculum. First, teachers need to reflect about different positions in the philosophy of mathematics and the implications that adopting a particular view has on mathematics education in the school. Second, teachers need to consider the reconceptualization of mathematics education based on research results. In particular the guidelines highlight the work of Ernest (1991) about the connection between philosophy of mathematics and mathematics education, and Brousseau's (1986) theory of didactic situations[3]. Third, teachers need to consider views of school mathematics as a "powerful intellectual tool whose mastery provides intellectual privileges and advantages" (MEN, 1998, p. 29, my translation), and as knowledge living in a social and cultural context in which students, their interests, feelings and culture are important in the learning process. Fourth, teachers have to discuss curricular models. A three-dimensional tool for curriculum organization includes a reflection about the general learning processes at stake, the basic knowledge and specific processes linked to a particular mathematical system, and the context which surrounds the student and that gives meaning to the mathematics he learns and which is represented by the problem situations –of mathematics, of daily life, of other sciences– that teachers provide to students in order to learn mathematics. These three dimensions can be combined in different ways in order to produce different curricular models. The guidelines invite teachers to develop their own. Fifth, teachers need to consider assessment. The guidelines discuss the central ideas for mathematics education related to broader changes in the assessment system where a variety of assessment forms are put together in a qualitative system in which general outcomes, described in terms of minimum levels of achievement, are operationalized as observable indicators of behavior. The latter allow teachers to make a judgment of students' achievement in relation to stated outcomes.

Finally, the third section of the guidelines addresses the issue of mathematics teacher education. Notions such as professionalization, professional development, innovation and research are key ideas in the agenda of a policy aiming at the transformation of teachers into *mathematics educators* with the scientific discipline of Mathematics Education as their area of expertise.

Facing the paradoxes?

In the case of Colombia the paradoxes of inclusion and citizenship enter the educational scene given the existence of a particular history as an underdeveloped country, and the presence of a political constitution, together with an educational law, in the frame of a neoliberal economic and political management. It is in this scene where the current mathematics education reform is taking place in schools, one of them Esperanza Secondary School. The reform discourse, being put forward among others by the National Curricular Guidelines, comes as well to be a part of

[3] It is interesting to think about the effects of the internationalization of mathematics education research and how there is an import of ideas from developed to developing countries in the shaping of the foundation for national curricula. Some reflections about this topic are presented in Vithal and Valero (2003).

this scene. We can question the role that those guidelines play in relation to the paradoxes previously mentioned.

Skovsmose and I (2002) have identified in literature four main interpretations of the meaning of mathematical ideas being "powerful"[4]. One interpretation emphasizes that the power of mathematical ideas resides in the potential for being part of logic, abstract constructions. The emphasis on mathematics curricula being a list of essential topics –and their associated ways of thinking– to be learned support a view of powerful from a *logical* perspective. This interpretation is very much connected to mathematics and its structure. A second interpretation deals with the learning experience of the individual. What counts is what students grasp and make meaning of in their process of developing mathematical thinking. This interpretation from a *psychological* perspective is grounded on most of the international research on mathematics education with a dominant concern on learning processes. Curricula organized around psychological meaningful ideas represent this view. A third interpretation emphasizes the socio-cultural experience of students, that is, the opportunities for students to participate in the practices of a smaller community or of the society at large. This *cultural* interpretation highlights the students' foreground – the way students interpret their future possibilities to engage in meaningful action– and their background –the social, cultural, economic and political environment in which they have lived. Curricula that integrate a cultural and political critique based on students' own life experiences exemplify how this interpretation is a necessary and complementary perspective to the two interpretations above mentioned. Finally, a *sociological* interpretation of powerful mathematical ideas stems from a critique of mathematics and its effects when used as a resource of power in technological actions in society. The emphasis on the potential risk that is associated with the use of mathematical tools when making social decisions makes a questioning of mathematics an essential part of any learning related to democracy in society. Curricula that integrate activities opening space for such a critique represent this type of interpretation. Skovsmose and I (2002) have also argued that mathematics education, intending to face the paradoxes of inclusion and citizenship, needs to adopt all these interpretations as essential and complementary. The dominance in a curriculum of one of those interpretations may reproduce imbalances that have been associated to the contribution of mathematics education to exclusion of many students from educational practices.

An analysis of the discourse that the Colombian Curricular Guidelines put forwards (Valero, 2002, pp. 131-133) shows that there is an emphasis on the logical interpretation of "powerful mathematical ideas". As shown above, the guidelines state the importance of mathematics as powerful thinking tools, the relevance of conceptualization and abstraction as aims of the curriculum, and the necessity of developing knowledge about the different system areas of mathematics and their associated thinking abilities, among others. The maintenance of the view of school mathematics as systems (in contrast to other possible organizations of school mathematics) keep a link to structuralist views of school mathematics which have been associated with the abstract, procedural character of school mathematics in the previous curricular guidelines. Furthermore, the choice of particular research literature (Brousseau's theories) as illustration of studies that can be of use for the

[4] For an extended discussion about power in mathematics education see Valero (2004)

understanding and reconceptualizing school mathematics also hint towards the adoption of an internalistic view of the discipline and of the practice of teaching and learning mathematics (Skovsmose & Valero, 2001, p. 40-41).

The depth of the explanation given to these ideas contrasts with the loose and tentative statements provided in relation to the psychological, cultural and sociological interpretations of "powerful mathematical ideas" in the document. Concerning the psychological orientation of the guidelines, there is not much that will give an indication of the concern for the inclusion of psychologically meaningful ideas in the curriculum, except for the mention of constructivism as a recommended epistemological position to adopt when thinking about mathematical learning. Although the guidelines mention the issue of culture and "paying attention to students' culture"(MEN, 1998, p. 30), it is not clear whether the interpretation of culture adopted transcends a simple recognition of all people making part of a human group –with particular features and particular preconditions for learning. The mention and discussion of culture and its role in mathematics education is not as broad as the description and emphasis on the mathematical content. Besides, considerations of cultural context seem to be reduced to the necessity of providing a task-context in problem situations. Finally, there is not a clear indication in the document of a critical, sociological interpretation in relation to the role of mathematics and mathematics education itself in social and technological action. In contrast to other curricular guidelines (e.g., NCTM, 2000, where there is a clear statement of justification for the teaching of mathematics in society, some of which could open a sociological and political space in the curriculum), the Colombian guidelines do provide a contextualization for the teaching and learning of mathematics within a broader social and political theoretical justification.

The Curricular Guidelines for mathematics in Colombia, as a frame of reference for teachers' curricular design in mathematics, offers an incomplete frame for tackling the challenges raised to mathematics education by the current global, informational society. The cultural and sociological dimensions to the "power of mathematical ideas" in schooling are not realized in the document. Still, being only a guide for curriculum design and implementation, and not a mandatory curriculum, there could be possibilities for teachers to integrate these missing perspectives. The interesting question is how, within the autonomous space that the educational reform leaves to school communities to decide about their practices, possibilities for facing the paradoxes emerge.

The micro-context of mathematics education reform in Esperanza School

In 1999, when I visited Esperanza Secondary School, the school was in constant alteration. The immediate school environment was always moving, so was the school. The heavy and slow bureaucracy in the local administration was connected with the lack of a formally appointed rector. Larger confrontations between the Teacher Union and the national government led to frequent stop of activities. Long strikes forced teachers to reschedule activities during weekends to catch up with missed lessons. Parents supported school activities but also caused troubles. Extraordinary teachers' meetings took place to solve conflicts with parents. The

change in the National System of Evaluation of Educational Quality forced the school to participate in a standardized test for 7th and 9th graders. This implied not only preparation, but also dedication of time to discuss the implications of such an evaluation on teachers' career. The debate about the privatization of public education also entered the scene at that moment… Shortly, mathematics education was taking place in the school in an environment of constant perturbation. Mathematics teachers had to respond not only to mathematics-related challenges, but also to the larger challenges that the local, national and global contexts were imposing on them.

In contrast to this, mathematics teachers have found some ways of working through the changes that the educational reform of 1994 introduced. The group of mathematics teachers has managed to organize the teaching of the approximately 910 students in the school, from 6th to 11th grade, all of whom had mathematics as a compulsory subject. Julia, Mercedes and Viviana had been involved in a one-year professional development program run by a team of mathematics education researchers in a private university. This professional program, part of a teacher professional development initiative of the local educational authorities, gave them practical and conceptual tools to actively engage in curriculum design, implementation and enquiry in their school. These three teachers have also managed to "infect" Ana and Laura and the school leaders with the bug of innovation. The group was moving forwards, but still struggling with the many demands of change.

Although the reform provided a frame so that teachers could work on the design of their own curriculum –in agreement with the school's institutional educational project and taking into consideration the Ministerial Curricular Guidelines–, the team of teachers in Esperanza had not been able to dedicate much time to this activity given the multiple new demands that divided their attention. One of the most challenging transformations was the creation of a new assessment system and the demand to teachers of constructing a qualitative outcome-based assessment system that suited the school and teachers' collective formulation of attainment goals[5]. Teachers perceived this as a demand that could not wait, not only because of its implications for everyday assessment, but also because of the general change in the national high stakes examination at the end of grade 11th. Teachers had to make sure that students had a chance of coping with qualitative assessments both in the daily life and at the end of their schooling. Thus, teachers continued to use the previous compulsory curriculum (MEN, 1991) as a reference, but make advantage of a diversity of new textbooks to guide their teaching. Teachers individually and as a group tried to respond as well as they could to the process of change.

Despite the lack of engagement in a curricular design activity, the team of mathematics teachers and the physics teacher designed a collective project in order to tackle the problems they have identified in their subject-area. The formulation of this project starts from the recognition of the connections between the general current demands to students from the Colombian society –as formulated in the Political Constitution and the General Law of Education; the commitment of the school with the improvement of students' life conditions –as formulated in the school's institutional educational project; and the potential contribution of mathematics education to the education of democratic citizens –as formulated in the Colombian

[5] This was the result of the Colombian operationalization the international agreement on "Education for all" (UNESCO, 1992) and the installation of an outcomes-based education.

Curricular Guidelines and international trends of mathematics education reform. The justification for the project and its theoretical foundations make clear that teachers interpret the demands of mathematics education reform in relation to the large social order in which their practice is embedded. Furthermore, one can find relations between the project and diverse ideas that make part of the cultural frames that, at the end of the 1990's, dominated in Colombia.

The project was conceived as a long-term strategy with the intent of developing seven interconnected actions: (1) The use of portfolios as means of consolidating students' learning and supplementing assessment. (2) The realization of special workshops in which students will have the chance of using diverse concrete materials in playful activities that contribute to a more meaningful mathematical learning. (3) The development of real-life projects which allow students establishing connections between mathematics and society, and developing a critical stance towards the role of mathematics in society. (4) The introduction of graphic calculators as a technological resource in mathematics teaching and learning in order to promote richer mathematical experiences for students. (5) The realization of school and inter-schools "Mathematics Olympiad" in mathematics and physics, with the intent of promoting problem-solving capacities and developing a sense of healthy competition among students. (6) The participation of teachers in diverse professional activities, inside and outside the school, in order to implement the previous five actions, reflect on their practice, and communicate to other colleagues the achievements reached. (7) The engagement of teachers in a systematic enquiry of student's learning as a means of tracking the impact of the previous six actions on mathematics education in the school, and of providing feed-back for the further development of the strategy in the long-term. (Esperanza, 1999, pp. 3-4)

Even though these actions emerged from the teachers' perceptions of their needs and problems in the teaching of mathematics to the students of Esperanza School, they keep a connection with different discourses that, from the macro-context, pose demands to teachers' work. These discourses penetrate practice and get reified in the micro-context of mathematics education in the school. It is possible to identify the following ideas in operation. First, the need for accountability of social processes illustrated by means of educational assessment has been particularly emphasized by the technocratic rationality of political parties with neoliberal and neoconservative agendas around the world and in Colombia, as well. The discourse of evaluation and assessment is recontextualized by mathematics teachers and, in the case of Esperanza, is expressed in a concern for constructing functional assessment devices. Second, the need of individual engagement in learning by motivation and affection is one of the central points of individualization processes. For teachers in Esperanza attention to the individual goes hand in hand with providing sources of meaning for mathematical instruction. Third, the need of connecting school with other arenas of practice, such as everyday-practice and work, are demands being posed by the role of education as a tool of governmentality. The idea of education as preparation for active participation in society and in the labor market is transformed by the group of teachers to a concern for making mathematics learning useful in students' lives. Fourth, the need of getting involved in the technological development of society and in the consumption of technology is constantly highlighted as part of the discourse of the informational society. For teachers this is transformed in the concern for the involvement of IT tools (computers and calculators) to support

mathematical learning (in an environment with precarious resources). Fifth, the need of creating standards of competition which are an important element in the discourse of internationalization, globalization and the open markets economy is transformed by teachers in a concern for allowing students to have positive competition experiences in mathematics, among themselves and with other schools. Finally, the need for the professionalization though innovation and research is a paramount feature of the "learning society" discourse. Teachers have participated in professional development strategies and have translated these ideas and demands into a commitment to an active learning from a systematic, collective examination of their own practice.

These discourses and their reification in different spheres of practice constitute frames of action for mathematics teachers in Esperanza. In the every day of school life, and in each of the mathematics lessons teachers are finding ways of coping with and responding to the multiplicity of challenges that fall upon their shoulders. With this variety of strategies they struggle to provide a mathematics education that may contribute to students' lives. Whether their efforts actually represent a reaction to the paradoxes of inclusion and citizenship is uncertain, but it is at least the best they can offer to the students of Esperanza Secondary School.

Linking macro, mezzo and micro contexts in mathematics education research

There is no doubt that school mathematics change, as well as school change in general, is a complex phenomenon and that an understanding of its intricacies and contradictions has been a central challenge for mathematics education research in the last two decades. A great amount of research in many countries has been associated with the development of improvement initiatives and with the evaluation of reform projects, and many results have illuminated the advances and pitfalls of change. Kilpatrick (1997) reminds us that one of the most important lessons to be learned from the attempts of reform in mathematics education since the time of the "Sputnik Shock" is that, despite being often construed as a technical problem, "changing how and what mathematics is taught to our children is not a technical problem. It is a human problem that demands an understanding and appreciation of how people work together in classrooms to learn and teach and do mathematics" (p. 6). I would add to this realization saying that the human problem of mathematics education reform demands an understanding that goes beyond classrooms. In fact a great deal of research literature during the last decade has provided more insight in the operations of reform in classrooms (for example, Cobb, Yackel & McClain, 2000). Such an understanding needs to embrace the organization of mathematics education in schools as a whole (Perry et al., 1998) and the organization and construction of mathematics education discourses and practices in larger fields of social action (Valero, 2002).

In my analysis of change in Esperanza Secondary School I illustrated that it is necessary to examine the different layers of context constituting the practices happening in the school, in the classrooms. These contexts, more than being simple "surroundings", are levels of social action in which ideas, discourses and associated practices are helping the constitution of instructional practices in mathematics in

schools. Through the case of Esperanza Secondary School I intended to illustrate how this diversity of layers of context interconnect and how the examination of their connections allow constructing a fuller picture of the complexity of mathematics education reform.

Seeing the world from a perspective of globalization and internationalization does certainly imply widening the lenses of research. Research on mathematics education using lenses adjusted to see the intricacies of micro-levels of practice risks ignoring the challenges posed by current social processes operating far away from classrooms. The systems of reason that provide meaning to educational practices are partly produced in macro-structures. Mathematics education research needs to grasp the way in which macro and micro levels of practice are constantly intermeshing in the constitution of mathematics education. I hope to have illustrated that facing the paradoxes of the informational society is a task not only for practitioners but also for researchers. A globalized also world puts at stake the constructions of mathematics education research.

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